BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's Rules	)	ET Docket 98-153
Regarding Ultra-Wideband Transmission Systems	)	

To: The Commission

COMMENTS OF THE U.S. GPS INDUSTRY COUNCIL ON TEST DATA SUBMITTED BY THE NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION REGARDING POTENTIAL INTERFERENCE FROM ULTRA-WIDEBAND TRANSMISSION SYSTEMS

The U.S. GPS Industry Council ("the Council"), by its attorneys and pursuant to a Commission Public Notice,[1] hereby submits these Comments on the Report of the National Telecommunications and Information Administration ("NTIA") concerning the results of empirical tests conducted into the impact of certain ultra-wideband ("UWB") transmission devices on selected federal radio systems.[2] The NTIA Report addressed the assessment of UWB interference into receivers and systems that were not associated with or part of the Global Positioning System ("GPS"); a second report addressing the impact of interference from certain UWB transmission devices into GPS receivers is expected to be produced by NTIA later this month.[3]

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[1] Report No. DA 01-171, *Comments Requested on Test Data Submitted by the National Telecommunications and Information Administration Regarding Potential Interference from Ultra-Wideband Transmission Systems (ET Docket No. 98-153)* (released January 24, 2001).

[2] NTIA Special Publication 01-43, "Assessment of Compatibility between Ultrawideband Devices and Selected Federal Systems," Lawrence K. Brunson, et al. (January 2001) ("NTIA Report"). The Commission also sought public comment on a second, companion NTIA report, NTIA Special Publication 01-383, "The Temporal and Spectral Characteristics of Ultrawideband Signals," (January 2001).

[3] NTIA Report at vi n.3.

I. INTRODUCTION

The Council is a non-profit 501(c)(6) industry trade association whose mission is to act as a GPS information resource to the Government, the media, and the public.[4] Its purpose is to promote sound policies for the development of commercial markets in civilian applications, while preserving the military advantages of GPS. The Council provided extensive comments and reply comments last Fall in response to the Commission's Notice of Proposed Rule Making in the above-captioned proceeding,[5] and has been an active participant in every phase of this proceeding (and associated UWB proceedings) at the Commission.[6]

II. DISCUSSION

A. The NTIA Report, Though Based On Non-Comprehensive Testing And Incomplete Analysis, Confirms The Detrimental Interference Impact Of UWB Transmissions.

The findings reported in the NTIA Report, even though devoted to assessments of UWB interference into non-GPS radio receivers and made dependent on the report of findings on interference into GPS receivers due later this month, buttress the arguments the Council has been advancing. They show that "UWB" is not a class of emitters, but is an umbrella term that can describe a wide range of of devices that vary with effective isotropic radiated power, emitter density, and transmitter activity factor. A single emitter can provide devastating interference while not violating the Commission's current, frequency-domain-based Part 15 rules on power

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[4] Current membership includes the principal U.S. manufacturers of GPS equipment C *e.g.*, Boeing, Honeywell, Magellan/Orbital Sciences, Rockwell International, and Trimble.

[5] *Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, Notice of Proposed Rule Making, FCC 00-163, slip op. (rel. May 11, 2000) ("*NPRM*").

[6] *See* Comments of the U.S. GPS Industry Council, ET Docket No. 98-153 (filed September 12, 2000) ("Council Comments"); Reply Comments of the U.S. GPS Industry Council, ET Docket No. 98-153 (filed October 30, 2000) ("Council Reply Comments").

outputs. The operation of UWB devices in uncontrolled, network (i.e., multiple-device) situations is particularly problematic.[7]

B. NTIA's Non-GPS Test Results Cannot Form The Basis For Any General Rules That Permit UWB Operations On Any Basis In Bands Below 3.1 GHz Or On An Unlicensed Basis In Any Band.

In the Council's view, the test results reported by NTIA cannot form the basis for any rules of general applicability that would permit UWB operation. Indeed, they reveal the existence of an interference problem of sufficient magnitude to preclude all UWB transmissions below 3.1 GHz, and to permit unlicensed operation of UWB devices only above 3.1 GHz, provided that such UWB devices are not permitted to operate in any restricted or safety-of-life band.

There are several reasons for this. First, the Council is unconvinced that the NTIA tests (not only the tests reported in the NTIA Report, but also the tests to be reported in the forthcoming report of test results on GPS receivers) are looking at the true interference threat posed by UWB devices. One of the fundamental problems with current experimental testing is that the potential interference threat from UWB technology is totally unquantified. The NTIA Report considers as UWB devices any device with an instantaneous bandwidth of 25 percent of more of its center frequency.[8] This is a loose label that does not specify a modulation or communication technique, and that provides insufficient details on the interference threat that the broad range of devices meeting this definition would pose to operational services with millions of users if included in an overlay sharing proposal.

Second, the Council is not convinced that any of the reported or ongoing tests of UWB devices have concentrated on the most serious interference threat – i.e., they have not tested for

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[7] *See* NTIA Report at 6-1 – 6.5.

[8] *Id.* at v. For a UWB device with a center frequency of 2.0 GHz, for example, the bandwidth would be at least 500 MHz.

the total amount of interference that would be produced by one or more UWB communications networks operating on a continuous basis at peak power and capacity with a high data rate. This information is essential to provide affected services, consumers, and regulators with a realistic understanding of interference truth and operational safety margins.

UWB, as that term is currently being used, represents the reincarnation of the spark gap transmission technique as a "novel" communications approach that supposedly enables sharing with operational services. In reality, UWB is a stalking horse for expanding unlicensed experimentation in network communications to bands throughout the 1-6 GHz range (and beyond). These bands are allocated to hundreds of services with thousands of licensed and operational systems, particularly in the 0 – 3 GHz range. If UWB using currently-proposed techniques is permitted in this frequency range, there will inevitably be a rapid evolution from spectrally inefficient pulse position modulation UWB devices that possess safety-related attributes but limited commercial and consumer market utility, to UWB devices that employ code division multiplex ("CDMA") modulation techniques which are commercially viable in network applications with explosive growth potential. There has been absolutely no operational experience or empirical testing of those large-scale CDMA communications networks that can exploit the UWB definition propounded above and gain free access to allocated spectrum on an uncontrolled, unlicensed basis.

C. The NTIA Tests Do Not Assess The Impact Of UWB Emissions (Either Monopulses Or Ultrawideband CDMA) On The Noise Floor.

The critical technical, operational, and business challenge is to determine whether the noise floor can be managed on a shared basis among services with different business goals and customer objectives. Ultrawideband CDMA faces few of the limitations of UWB monopulses. The technology exists today for widespread use of very high frequency, very wide bandwidth CDMA

networked communications.[9] The testing to date has centered on only a few examples of monopulse transmissions.

There have been no serious studies of what happens to the noise floor in an environment where multiple, large-scale, saturated networked communications services from different competitors are operating on a continuous basis with high data-rate transmissions and peak power, even though operational examples exist today in the license-free local area environments (e.g., at 2.4 GHz). However, any expectations of negligible or no impact are unrealistic given the fact that even with the limited nature of the experimental testing performed to date, the monopulse waveforms indicate degradation to GPS and other government systems at levels 20 to 30 dB below the limits in Part 15 of the Commission's rules today.

The suggestion of some UWB proponents that there is available unused spectrum below the noise floor is illusory. Current operational services include licensees who have purchased spectrum at auction from the U.S. Government. These licensees are highly motivated to achieve increasing digital efficiency by using all of the spectrum in their allocations, including that which is supposedly below the noise floor. In addition, virtually all space-based systems are very sensitive to the noise floor and often operate below it. Many safety-of-life services, to the extent that they are allowed a noise floor at all, attempt to include an internationally-recognized "safety margin" that enables them to have some cushion against unexpected or unknown sources of interference before such interference rises above the noise floor with detrimental and harmful effect.

The Commission has historically attempted to minimize the increase in the noise floor caused by unwanted emissions by placing limits on out-of-band emissions, and by drawing a

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[9] Significantly, this technology supports communication devices at frequencies *beyond* 20 GHz. Under such circumstances, there would be no need to superimpose transmissions over the congested 0-3 GHz area of the nation's communication spectrum.

distinction between intentional and unintentional emissions. The introduction of intentional emissions into operational bands: 1) using a broad label that can be exploited by large scale communications networks; 2) providing unlicensed status that accelerates large scale experimentation (while affording no control or recourse if harmful interference occurs); and 3) having no model to date demonstrating that competing wireless communications companies can self-regulate to preserve the commercial utility of the noise floor on a shared basis will inevitably accelerate the rise in the noise floor.

D. The Commission Should Be Very Hesitant To Embrace An Unlicensed Environment For UWB, With Its Multiplicity Of Envisioned Applications And Aspirations Of Ubiquity, Given Its Experience At 2.4 GHz.

A scenario that is instructive to the Commission's stated desire to establish an unlicensed regime for UWB devices is playing itself out today in the unlicensed band at 2.4 GHz, where congestion (due to the density of unrelated transmitters) is bringing about a rapid rise in the localized noise floor which is in turn reducing the range for reliable communications.[10] The local area networks (LANs) designed for use in the 2.4GHz band were initially proposed for exclusively indoor operations. While perhaps unforeseen at the outset, their extension to outdoor use was a natural evolution, as desktop computers gave way to laptops that are now giving way to the increasingly ubiquitous personal digital assistants. Additionally, this band has migrated from high reliability commercial applications to consumer home-based and neighborhood-based communications networks. As the speed of computers has risen along with the demand for music and video, network bandwidths have multiplied and it is this consumer demand for bandwidth

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[10] *See*, "Raft of New Wireless Technologies Could Lead to Airwave Gridlock," Jared Sandberg, The Wall Street Journal (January 8, 2001) ("The [2.4 GHz] band has been swamped in recent years by communications companies using it for data networking, resulting in a free-for-all of radio signals. Yet the FCC considers such interference to be the price of doing business in the band. Engineers must build wireless systems robust enough to coexist with such "noise").

associated with the Internet that is providing the bulk of the drive for more mobile frequencies.[11] A network supplying e-mail operates at a much lower bandwidth than a network supplying video images.[12]

The unfolding experience at 2.4 GHz reveals starkly that there is a need for a "frequency commons," and the Commission's task is to figure out how to create a UWB environment that avoids the "problem of the commons." [13] There is no question that it is in the national interest to figure out how to solve this problem. Certainly, the use of very low power, very wide bandwidth transmission devices is a component of the solution. However, it is important to evolve a self-regulating mechanism for use in unlicensed bands that will prevent the degradation of commercial utility in a new frequency commons. Furthermore, until the full implication of multiple diverse and potentially incompatible communication networks is understood, the existing telecommunications infrastructure should not be forced to face the unhappy and ill-advised prospect of having a UWB frequency commons overlaid upon it.

The legitimate need for spectrum for the mobile Internet calls for a carefully crafted strategic experiment. A segment of spectrum 3GHz wide that is located above 3.1 GHz (excluding restricted bands) should be established for very low power ultrawideband devices. Potential users

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[11] These developments are largely a function of the economics of electronics. The cost of electronics has been dropping at a rate of 30 % per year for the last decade for anything that is based on a mass-producible product. This has been largely a consequence of Moore's Law as applied to integrated circuits. R&D cycles are typically 1 to 3 years. This means that the projected costs of the R&D product will be half of what its cost would have been today. The frequency at which one can operate at the same cost is basically doubling every two years. This has been demonstrated in the rapid rise of the processor speed of laptops.

[12] Current experience with the Internet indicates that during peak periods, all the available bandwidth is consumed. It is when it is consumed that responses to individual Internet queries slow down. It can be safely assumed that in the efficient use of telecommunications, all available bandwidth will be consumed.

[13] The fundamental appeal of UWB for communications is that it proposes to allow free, unlicensed use of radio spectrum now assigned to others. This same appeal reintroduces the "problem of the commons." In Colonial America, a common pasture was often situated near the town center where all citizens were allowed to graze their cows free of charge. The sustainability of this system worked very well when there were 150 cows in a village grazing in a pasture that would support 250 cows. But, when the number of cows inevitably grew to a number that exceeded the capacity of the pasture, the ability for anyone or anything to derive benefit from this pasture was defeated.

should be strongly encouraged to form an industry group to maximize utilization and to preserve the value of this new frequency commons. Only if and when they demonstrate that diverse sharing of a commons is an economically workable long-term allocation concept, can the Commission consider extending this experiment to higher powers and more frequencies – again away from bands restricted for safety purposes.

E. The Commission Should Initiate A Further Notice Of Proposed Rule Making To Provide An Opportunity For Public Comment On Any Rules It Proposes Once Comments On The Various Testing Programs Have Been Taken.

This rulemaking proceeding is addressing a complex and largely unknown subject, and the first test results in from NTIA reflect the need for the development of complex rules to accommodate UWB devices. No specific rule proposals were made in the *NPRM*.

Under these circumstances, and given the significance of the issues under consideration and the stakes involved for incumbent services, the Council believes that the Commission must issue a Further Notice of Proposed Rule Making (FNPRM) – before adopting any specific rules – to ensure that all interested parties have a reasonable opportunity to comment upon any rules the Commission may wish to establish based on the record developed to date. Such an approach is necessary to ensure that all services, operational and planned, are provided the regulatory certainty they need to meaningfully assess the applicable technical and business risks, and is mandated by the Administrative Procedure Act.

III. CONCLUSION

The UWB proposal gathered steam during the euphoria of the dot com mania where all things are possible and the new economy was creating a “free lunch” model. Unfortunately, the offer of a free lunch (or free spectrum) always means someone else is being forced to pay.

As with many alluring technology propositions, there is a strong element not only of national need but also of real potential. The challenge is not to seek ways to debunk or to bury UWB, but to harness its promise without unduly damaging the nation's IT economic engine.

Results of tests performed to date by NTIA, when factored together with economic realities and the experiences gained over the years with services that operate on unlicensed bases, confirm that no UWB devices should be permitted to operate below 3.1 GHz and no UWB devices (licensed or unlicensed) should be allowed to operate in bands restricted for safety-of-life. The Council is committed to the continuation of its serious effort to enable UWB technology to have an opportunity to demonstrate its mettle in today's complex IT marketplace, and encourages the Commission to consider its foregoing comments in the constructive light in which they were intended.

Respectfully submitted,

THE U.S. GPS INDUSTRY COUNCIL

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February 23, 2001

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